

# Microbiological Process Report

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## Activity of Microorganisms in Organic Waste Disposal

### I. Introduction<sup>1</sup>

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Disposal of diluted organic wastes poses a problem of vital importance to the many industries that use agricultural products. Food processors and dairies, as well as producers of fermentation products, antibiotics and other substances, acknowledge the necessity of waste disposal. Too often, the industrial microbiologist himself is unaware of the problems involved in waste treatment and follows the adage "out of sight, out of mind."

The concentration of industry has produced wastes of such strength and quantity that the waste load dumped into a receiving body of water is often too great for the size of a specific process. For example, a small dairy may discharge solids in its waste waters daily that would require 120 pounds of oxygen for its stabilization measured as biochemical oxygen demand. Since the solubility of oxygen in water is about 8 parts per million, only 8 pounds of oxygen is present in a million pounds of water. Thus the waste would require the oxygen in 15 million pounds (or 1.8 million gallons) of water, the amount found in a pond 8 feet deep, 300 feet wide and 100 feet long. Once the oxygen is depleted, anaerobic conditions conducive to the production of disagreeable odors set in, and water life associated with clean waters can no longer exist.

Many industries, much larger than the hypothetical dairy, have this problem increased multifold and must take means to avoid the degradation of the receiving waters. Indeed, the demands of our progressing civilization are such that waste waters discharged to streams must be reasonably clean.

Removal of organic solubles from an aqueous waste is a microbiological process conducted by a heterogeneous population of microorganisms found in the sludge. Quantitative and qualitative comparisons show changes in dominant species during aerobic treatment

of dairy waste (Jasewicz and Porges, 1956). Active sludge oxidizes about half the available organic material while converting the remainder into cell material (Hoover and Porges, 1949). Oxygen requirements are high during such synthesis. Considerable soluble material is rapidly removed and converted to a storage product that is readily used (Porges *et al.*, 1955). The rate of oxygen utilization during assimilation and synthesis is about 10 to 20 times the oxygen required during endogenous respiration. Equations showing these conversions and possible application of laboratory data are given in reports (Porges *et al.*, 1953; Porges, 1956).

Wastes may undergo a treatment in which aerobic activities of microorganisms predominate. Highly concentrated wastes may be submitted to an anaerobic digestion. Yet again, the treatment may take advantage of both types of microbial activity. The primary purpose of these treatments is the production of clean water. Soluble substances are converted by microorganisms to volatile gases and removable cell solids. The sanitary engineer designs processes to take maximum advantage of the activity of microorganisms. In papers II, III, and IV of this review, the authors present discussions of the biochemistry and mechanics in the biological treatment of organic wastes.

### REFERENCES

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<sup>1</sup> Presented at the 13th General Meeting of the Society for Industrial Microbiology, Storrs, Connecticut, August 26-30, 1956.

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